Introduction

Creation and exploration

lynamic spatial media decades before the proper technology exists

We intend for the computing system to be "built in itself" to the extent possible. The system will be designed around the same principles of visibility, physicality, and in-the-world-ness as the media that it supports.

/ and will happen in stages. V We cannot set forth a "grand As we come to understand what spatial computing is, the system will gradually ansition from drawing on conventional techniques to being its own

is a means to an end. The goal is a medium for Jated to mathematics, science, and human affairs. understanding hypothesis is that the necessary medium can't fit on a computer screen, so the first step is escaping the tiny rectangle.

Manifesto

other windows could appear to persist.

Forty-some years later the ubiquitous virtual location in The Cloud (itself a vessel computer. for dismal illusions--choose from a stable one of these iPad applications is rarefied and beyond. arcane-its macho, brogrammer/beardo techniques could hardly be further from the It is with all this in mind that we at CDG are infantilizing ease of use that is packaged and promoted.

The delicate illusion and metaphor of recede into a virtual "tab" or otherwise process a new notification.

The Desktop Metaphor introduced at PARC The revivified old ideas of "Virtual" and in the 70s was a breakthrough. It was "Augmented" Reality both accelerate the nothing more than an illusion, but this illusion illusory stakes. The former proposes to create was foundational for the comprehension and a synthetic world with such fidelity that we may adoption of mainstream computation. In step out of the real, while the latter attempts a short, by employing the Desktop Metaphor, high-framerate, personalized synchronization computer users could believe that their of the virtual on the real. When faced with a documents and applications lived inside a set choice between modifying reality before it of icons spatially arranged on a CRT display. reaches our eyes or cutting it out entirely, we When icons were activated, their contents reject the set-up as a false choice. We wish to would appear in a 2-D "window" with create and co-inhabit with all our senses a simulated occlusion, so that the Desktop and reality larger than our screens and richer than even our imaginations. And if there was something valuable in our word processors and web browsers, we will find a way to bring it Desktop is giving way to the "home screen," into the world. For too long has "computer documents are dissociated from even a interface" meant contorting the human to the

mainframe or the vaporous Desktop), and Our zeal may have us mistaken for retrograde the UNIX shell lives on through TTY fundamentalists. We are zealots. We are emulators as "ground truth" in the networked students of a forgotten past. And we are everage. While cats and toddlers swipe at iPads concerned with the foundational units of our and in some ways computing has never been new world-to-be. But we are pragmatic easier or more accessible, the knowledge prototypers at heart, and we will submit to and expertise necessary to create or modify great pains to catch a glimpse of what might lie

focused on our room. We're tongue-tied to talk about it, because the history of our language and our computer interfaces fixate on metaphor, and we are attempting to transcend personal computing is losing its coherence: mere analogy. When we point at a printout on the pixel-art trash can is now an ill-defined the wall and say that it is code to transform "archive." We seem to be saving everything, laser coordinates, when we point at a glowing and yet when the signal drops out or the chart and say it is the print queue, or when we battery fails we have nothing. Even when we point our laser at an e-mail label, we are not are "online," which is most of the time, the pointing to metaphors or illusions pretending to omnipresent search bar only offers us a be code and documents, we are pointing at the search in the narrowest sense, for we must thing itself. That's the goal at least. It's not a already know a name for what we're seeking. "view" on a git-backed directory. Our room is Never can we see the shape of the whole. not play-acting from a 3-D model we built of Images and text flash onto our screen, but no CDG. If we are still using inode-backed file sooner have they appeared then they must systems and constructing virtual perspective transforms, that is only because we lack the dissolve and allow our precious pixels to meta-materials and cheap-as-sand circuitry to truly bake our bits into the room.

Principles of Spatial Media Axioms Urges



We Want This

spread out! context and connections (seeing local structure)

shape of the whole, boundedness (seeing global structure)

openness and transparency

parallel representations

single viewpoint

Not This

speech-like

<u>Not This</u>



Physicalit

We Want This

persistent, stable, reliable	
physical, tangible, real	
writing-like	
the real world is the truth	

hands, feeling and manipulating computer input devices direct manip of real-world objects GUI



In-The-Worldness

We Want This

<u>Not This</u>

the room is the computer out and around, moving, looking situated — "here" is not "there" thinking with the body being with real people

sitting and staring cartesian dualism isolation, virtual avatars



A COMPUTING SYSTEM FOR DYNAMIC SPATIAL MEDIA

seeing things in isolation, reliance on memory

amorphous boundless space

black box, under-the-hood

peek-a-boo, ephemeral, fleetin virtual, ethereal, weightless, illusory

the database is the truth

the screen is the computer anything can appear anywhere

References

[filter example]

[representation gallery]

[seeing spaces poster] [unthinkable poster]

[big board] [identity and persistence 2/1 [virtual sprawl]

References

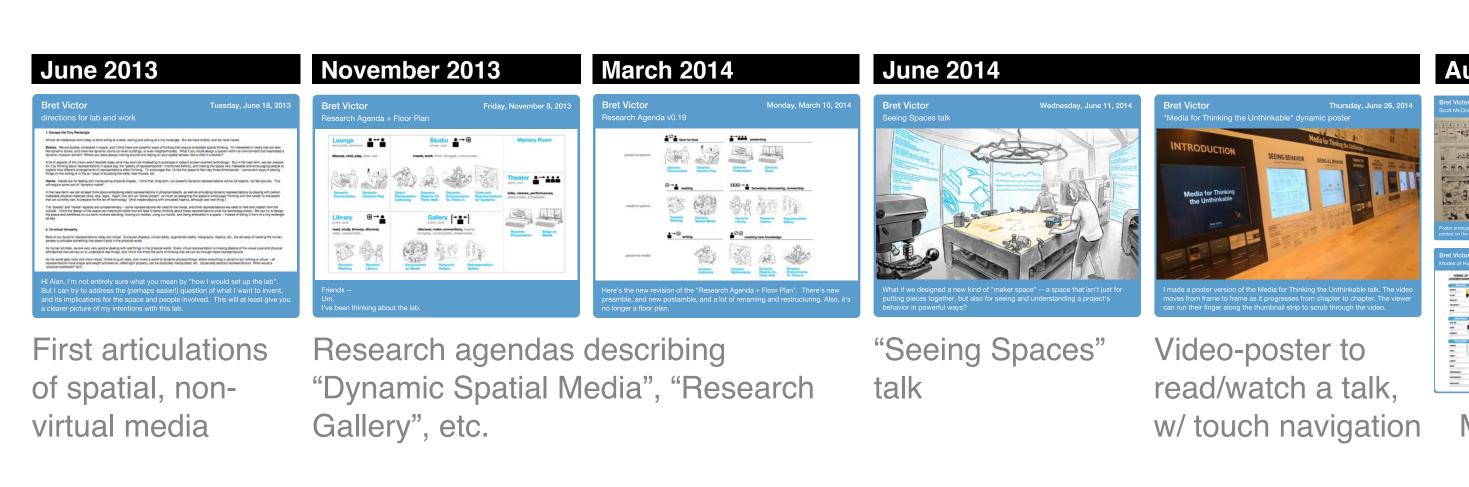
[identity and persistence 1/31] [virtual sprawl] [identity and persistence 1/31]

References

[dynamic spatial media] [dynamic environments-to-think-in] [identity and persistence 1/24] [brief rant end]

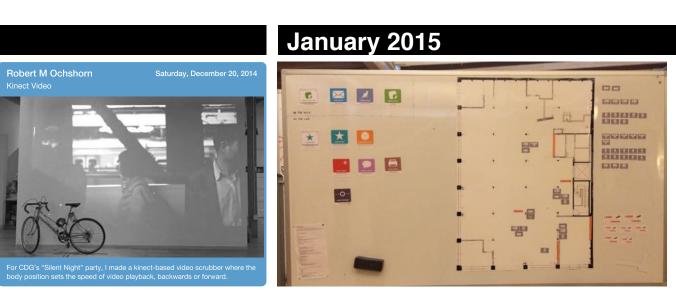
[identity and persistence 2/1] dynamic creative play]

History of Spatial Thinking at CDG

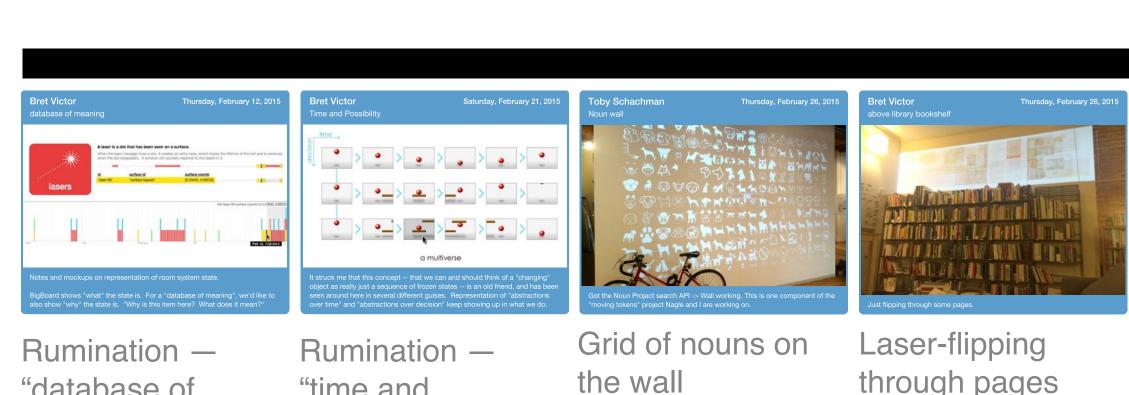




with movement of the body



the body system.



database o meaning" possibility

Proposal for a camera-projectorcomputer box World"

in a poster comic



with dynamically- by placing a block World" running, highlighted books in a location built in itself (v2)

Laser-selecting

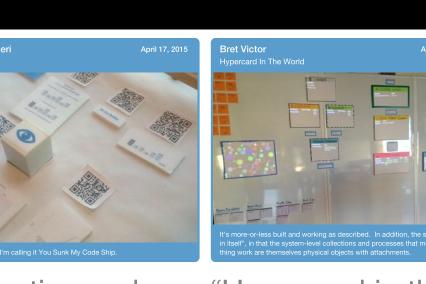
books on a shelf

April 2015

Proposal / spec for Navigating video Navigating code "Hypercard in the Ceiling archive of

above bookshelf

and respond to lasers.



art exhibition

retractable posters email archive

Proposal to use

in sync

June 2015 Les Clase Hinshi Saleguchi Les Clase Hinshi Sale

whiteboard comic to add to

Research gallery documentary



Lunch table "Why Big Box? touch display Who's Chipper"

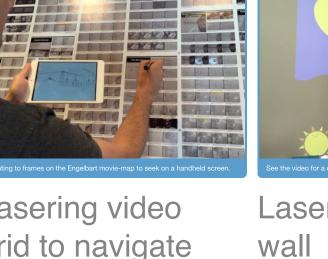
Navigating a video Rumination -

by lasering panels "virtual sprawl"

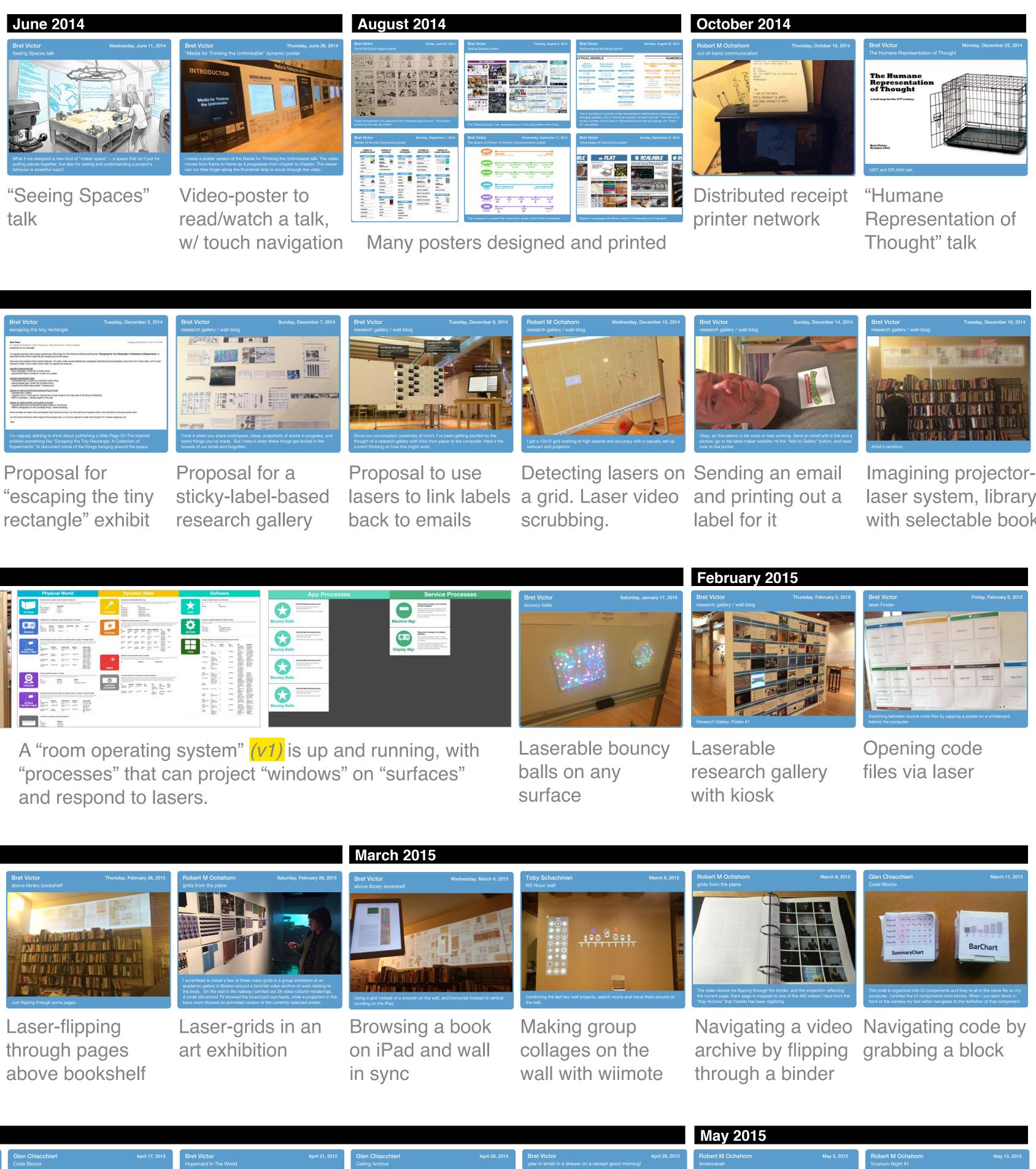
make sounds video on iPad

lasered animals grid to navigate wall

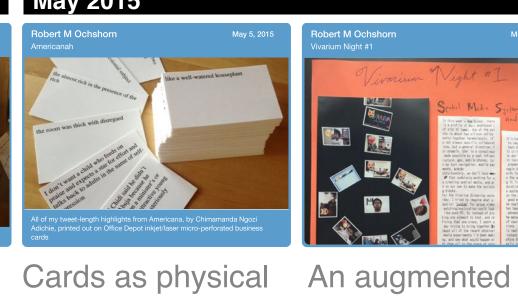
projector



tools for discussing a book palette

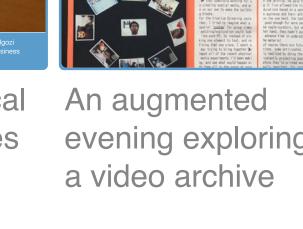






in a book

links to passages evening exploring



Thread highlightir and searching in

Poster context for Recognition of icon tiles

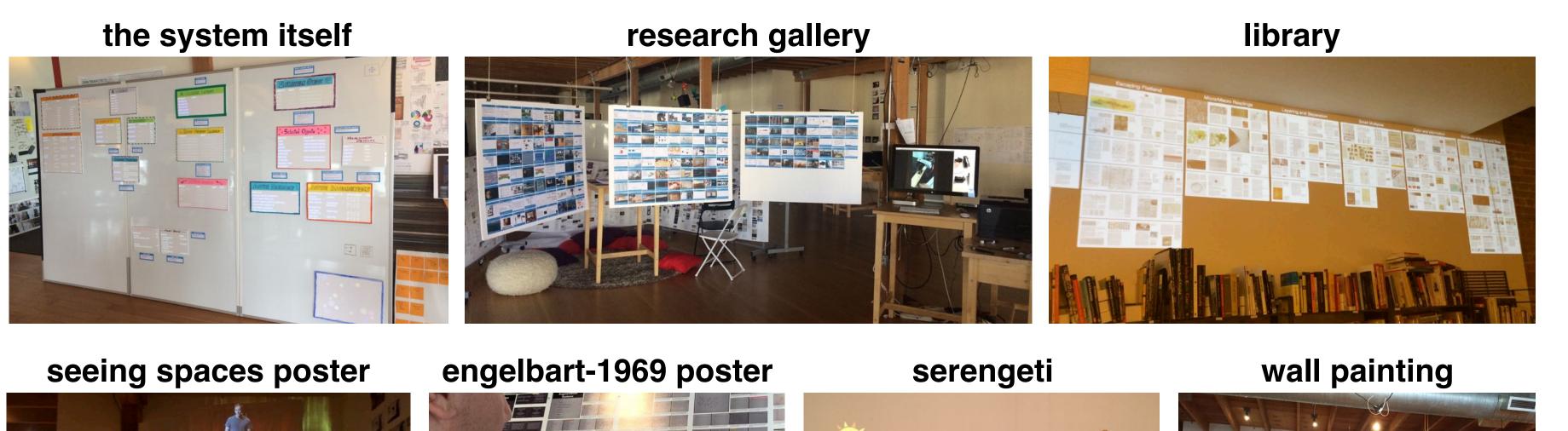


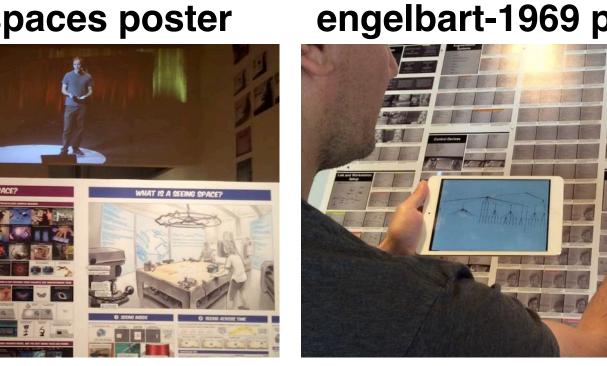


research gallery

Wall painting with Physical token Codex play-doh color with files virtually attached

Current Status as of July 2015





HARDWARE LAYOUT



NUMBERS OF THINGS IN THE SYSTEM

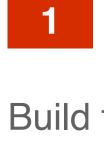
6 Macs, 6 projectors, 7 cameras

379 physical objects (18 root objects, 361 contained objects) 951 attachments

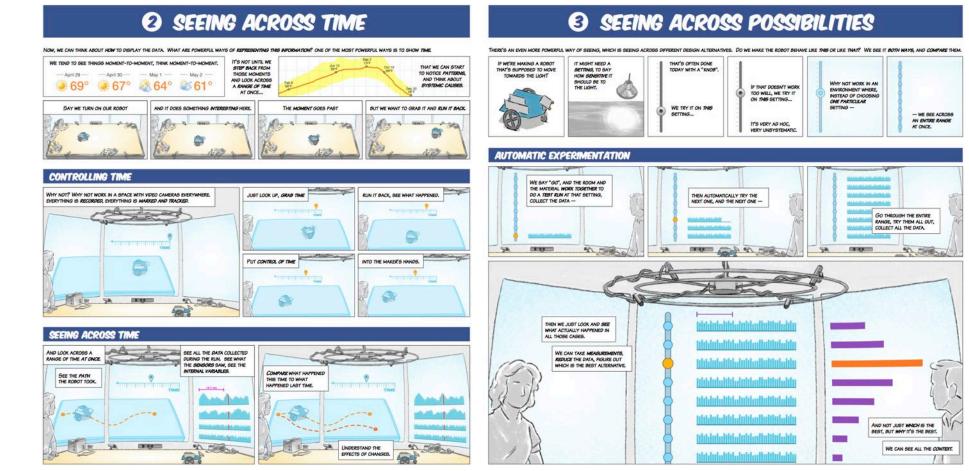
44 code attachments (18 daemons, 26 illuminations)

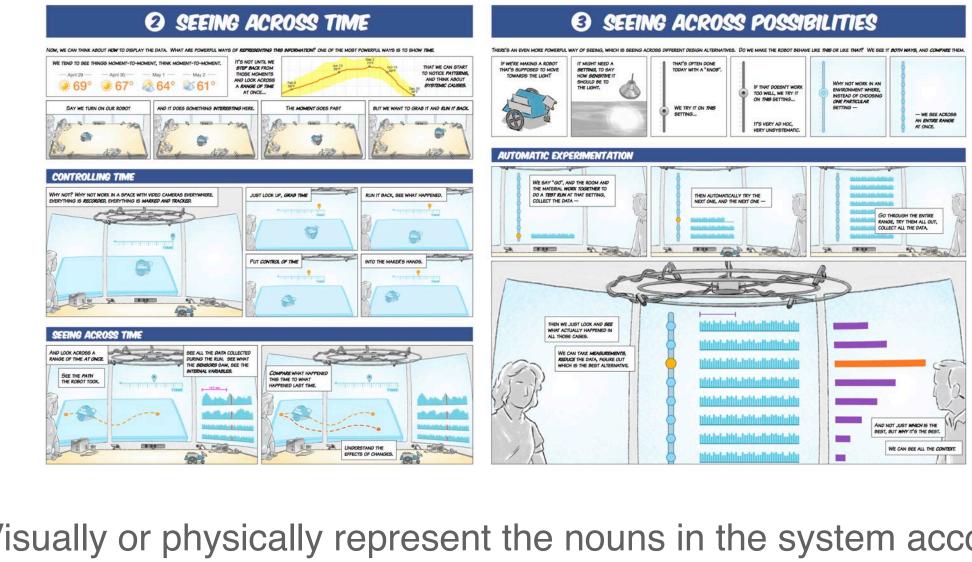
58 running processes (17 active daemons, 28 active illuminations, 13 machine processes)

30 code things "outside the system" in the filesystem (20 modules, 10 web apps)













nale he envisioned new form of thinking centers upon creating and exploring dynamic representations. Thinkers must be able to create these presentations with as little indirection as possible, so the dynamic medium can function as an extension of the mind. The goals are to get "programming" out of the tiny rectangle, and to eliminate "code" to the extent possible.

Perhaps "programming" by direct manipulation of large-scale objects and tangible, physical objects, using the hands and the body, etc.

Use the concepts and infrastructure from the previous phase to expand directmanipulation verbs beyond just programming the system itself, to creating dynamic behavior more broadly. This gets into the verb-oriented agenda items, such as -





Roadmap Goals Visions

won't develop as described here. This roadmap is just another way of trying to

1 APPLICATIONS (escaping the tiny rectangle)

Build the "escaping the tiny rectangle" exhibits, using "Hypercard in the World".

Relevant research agenda items include —

Dynamic Library	Research Gallery	Representation Gallery
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2 **SYSTEM** (nouns)

mplement a data model oriented around space, time, and possibility.

Visually or physically represent the nouns in the system accordingly. This probably won't fit in a tiny rectangle, so use the system itself to go big and spread out.

Build out the equipment as needed. (10's of projectors/cameras/etc)

3 **APPLICATIONS** (nouns)

Use the capabilities implemented in the previous phase to make would-havebeen-impossible spatial applications, particularly Seeing Spaces-like spatial "time and possibilities" representations.

Play with applications related to the noun-representation-oriented agenda items, such as -

Dyn Spatial Media	Dynamic Stage	Dynamic Library	Dynamic History
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Become familiar with thinking in room-scale nouns.

Significantly build out the equipment. (100's of projectors/cameras/etc)

4 SYSTEM (verbs)

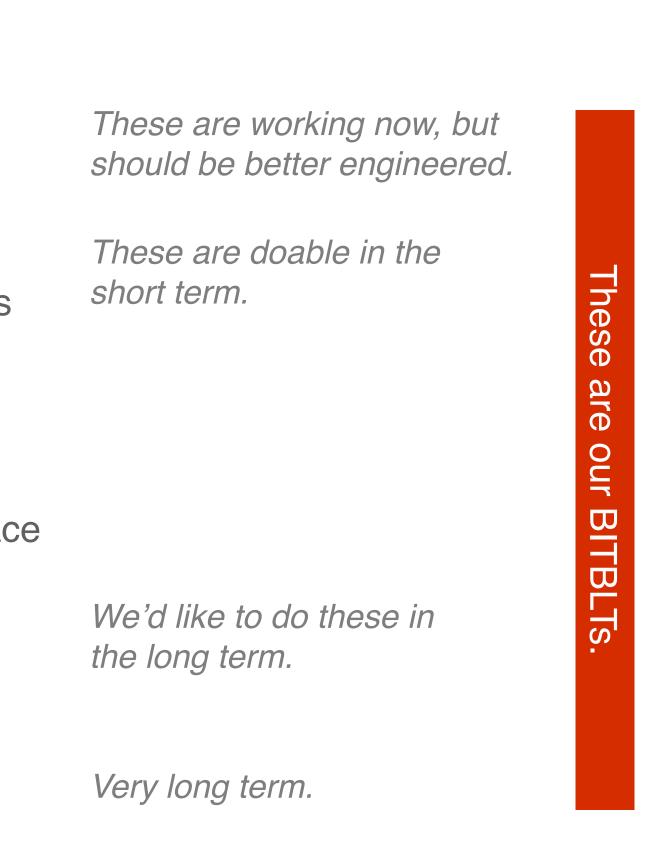
Represent behavior by direct manipulation of noun representations.



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5 **APPLICATIONS** (verbs)





COMPUTATIONAL METAPHORS

PHYSICAL INTERFACE

Track people's location, gesture Detect and parse voice Detect laser identity / buttons

igh-resolution illumination

Actuate and move object

Print or fabricate objects

Morph objects

Scan walls and objects

Attachments, instead of virtual filesystems and databases. Computationa processes and data collections are virtually attached to physical objects.

Responding to the environment, in nstead of messaging. Processes are ed not by direct communication, but by influencing the physical state (e. moving) or virtual state (e.g. adding data to a collection) and observing such changes around them.

Seeing the world, instead of querying a database. Objects look around themselves in space and time, and notice changes of interest. Objects see each other.

Dynamic ether? Perhaps the space between objects (the air, the background or "game board") can run processes and hold data.

WORLD MODEL / DATABASE / OBJECT MEMORY

Literally global. Every object on earth can be can be referenced with a unique id.

Gracefully incomplete. The real world is truth. The computer's model of the world is necessarily incomplete, and perhaps even inferred probabilistically.

Objects can see other objects. Queries can involve spatial Query across space. scope and orientation.

Query across time. Objects can see everything that has ever been. Queries can involve temporal scope, or can operate over time (like signal processing filters).

Query across possibility. Objects can fantasize. Queries can involve simulated future scenarios in parallel worlds.

Provenance and influence. Where did this data come from, and where did it go? It should be possible to reconstruct an entire chain of events.

First-class people? Perhaps a person should not be an "object".

INTERPRETER / RUNTIME

Simple implementation, in the STEPS sense. Can be looked at and understood. Eventually, to be realized physically in the system itself.

Flexible. Instead of provisions for anticipated features, the language should allow features to be added as their need is recognized.

Inspectable and hackable. We can see and visualize the inner workings of the interpreter. We have full control to change the runtime into what we want.

Instant update. One can make fluid code changes (e.g. dragging a slider) and the process should update immediately and fluidly.

FFI? We need some way of incorporating foreign code when necessary.

LANGUAGE

First-person objects. The author thinks from the perspective of the object.

First-class space, time, and possibility. The author thinks in terms of what the object sees, has seen, and could see.

Query syntax is not "blind", but is written or performed in the **Evocative queries.** context of what is being queried.

Richer than text. Images, graphs, etc., can be part of the code. (And not merely as comments.)

Directly-manipulable code. The language is designed for making continuous changes (e.g. dragging a slider) and seeing the response in realtime.

Direct referencing of physical objects. Programming involves pointing at relevant objects and data in the world, not typing their names.

Transition path away from screen. Towards programming by manipulating physical objects